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TECHNICAL MEMORANDUM. 19.

THE TECHNICAL DEVELOPMENT OF THE TRANSPORT AIRPLANE.

Report of the Aero-Technical Conference
of the Scientific Association for Aero-
nautics, March 5, 1919. 7.1

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THE TECHNICAL DEVELOPMENT OF THE TRANSPORT AIRPLANE.

Report of the Aero-Technical Conference of the Scientific Association for Aeronautics, March 5, 1919.

Mr. G. MADEJUNG, of Berlin, undertook the task of making a report on the above-named subject and made the following statement:

The abolition of military qualifications gives free scope to new technical possibilities in the development of transport airplanes, although some of the obstacles imposed by various requirements are scarcely capable of being overcome.

1. Flight must be made increasingly attractive to the passenger by all possible provision for his comfort. Among other details, he must be protected from dirt, wind, noise and cold in airplane trips, and this can only be managed by utilizing slow running pusher propellers.

2. In all kinds of transport the life and physical well-being of the passenger is of primary importance. Experience shows that head-long falls can be entirely avoided by the use of suitably constructed types of airplanes.

In case of accident, the passengers are generally injured through the wreckage of their cabin. The possibility of such injuries must be overcome by the manufacturer through the construction of a collision chamber between the engine and the cabin (like the luggage van between the locomotive and the passenger train), and the static insulation of the cabin must be

promoted. It is also necessary to avoid having sharp edges which might bruise the passengers in case of accident by leaving the cabin open in front (like a bath), or by having it covered with fabric; the cabane must, in particular, be far from the passenger's seats.

3. The economical management of aerial transport depends on limited breakage and wear of the airplanes utilized. Damages due to nose-diving or overturning are generally caused by the height of the landing-gear, which is dependent on the propeller in conjunction with the shape of the engines, such shape being unsuited to the requirements of the airplane. Unlike engines for boats and cars, in which the shaft should lie as low as possible, the height of the top of the airplane engine must be reduced as far as possible over the shaft.

4. Increased attention must be devoted to the attitude of the airplane in case of breakage. The stress on the airplane can be reduced by the timely breakage of the right part, especially in case of shocks from directions other than those of normal working. If there is a violent shock from the front, for instance, the landing-gear must break off smoothly in order to avoid overturning. By breaking off the landing-gear and lower wing, the fuselage may remain intact when the point of breakage may be calculated beforehand. Localized limitation of the breakage must be produced by the insertion of stronger parts; in this way, for instance, reinforcement of the lower fuselage spar

to the skids limits the breakage of the landing-gear.

5. Every effort should be made to facilitate the possibility of quick repairs, that is, quick repairs at forced landing places or even change of the broken part with a view to avoiding further damage through dismantling and transporting the airplane. The following points must therefore be developed: The fuselage in the engine projection, the protective chamber (core) the cabin, central fuselage (from the core to the end), the end of the fuselage with the rudder, and the skid should be detachable in several easily handled and easily changed parts, such separate parts being more easily manufactured, repaired, transported and controlled. As a consequence of this facility in taking to pieces, we obtain:

6. Uniformity. The utilization of interchangeable airplane parts, such as landing-gear, wings, rudders, etc. in as many different types as possible, also from different manufacturers, should be promoted in order to facilitate quantity productions. The provision of spare parts will also be reduced by standardization, and it will be easier to supply such spares in case of breakage.

Professor BENDEMANN, of Berlin, believes that the next step in the development of aerial transport in Germany will be the improved construction of small airplanes. The small airplane is also needed as a means of transporting a sole occupant, as in the case of small automobiles. One of the principal conditions

on which the favorable development of such aerial transport depends consists of good accessibility to the aerodrome. In Berlin, for instance, the "Tempelhofer Field" can be quickly and conveniently reached from all parts of the ground for an "aerial cab" undertaking of this kind, and is far more convenient than the Johannisthal Aerodrome. In addition to the lines laid down by Professor BENDEKANN as requisite for the development of the transport-airplane, the standardization of airplane construction is of the greatest importance in reducing the cost of construction and working.

Dr. QUITTNER, Berlin and Vienna, alluded to the necessity for a clear understanding as to what is actually expected from the transport airplane before the separate development of a transport airplane type is undertaken. He inquired whether such airplane should, in the opinion of the previous speaker, follow the design of the automobile, - that is, continue to be a "luxury" airplane, or be developed into a public means of transport (for several people). According to Dr. QUITTNER, the utilization of the airplane for transport purposes is bound up in the employment of giant airplanes as a rapid means of transport for several passengers in long distance journeys. The use of the small airplane as a private vehicle will then dwindle proportionally as the former transport increases. In the case of giant airplanes, such as the German R type, the conditions imposed by the first speaker are not generally applicable, in

so far as that the possibility of taking the airplane to pieces is of less importance. Standardization and limitation of type are, on the other hand, most important in the construction of R airplanes.

Herr ENGBERDING, Naval Architect, of Berlin, then addressed the meeting and commenced by saying that it was evident, from what had already been stated, that there were differences of opinion even in the realms of flight with regard to the question of the superiority of the small airplane or of the giant airplane for transport purposes.

From the standpoint of an aircraft constructor, he remarked, that the airship as well as the airplane would play an important part in future as a means of transport. On account of the strict necessity for secrecy during the war, the present high state of airship development is practically unknown in Germany, whereas the British, for instance, are evincing great ardor and interest in the immediate establishment of universal airship communication.

The newest naval airships on hand might be utilized at any time, without any further preliminaries, for oversea flights to America.

On the whole, there will be no rivalry between airship and airplane as a means of transport; each will be perfected in its own way. The airship is specially adapted for transporting heavy loads over long distances and more particularly over inland seas

or deserts where the airplane is practically incapable of competing with it. Localized airship transport within the boundaries of single countries is, on the other hand, bound to fall through or to form a mere branch line. Airship transport therefore comes under the heading of universal and international transport.

An essential preliminary in establishing international airship communication is the high cost entailed in the construction of turning-sheds or similar accommodation. During the war, transport by airship was greatly hampered by the lack of such accommodation. Ever since the beginning of the war, technicians have continually pointed out that turning-sheds should be built at once. These demands were always rejected by the military authorities on the ground that such construction would take up too much time, considering that it was not considered possible, from a military viewpoint, for the war to last so long as was actually the case.

The disadvantage of stationary sheds lies in the fact that when there is only a moderately high transverse wind, the airship cannot be got in and out with sufficient safety; and in civil airship transport it is absolutely necessary that a regular time-table should be followed.

The greater the distance to be traversed and the more important the gain in time thereby attained, the more chance will there be of the success of airship lines as compared with other means of transport. If, for instance, a steamer needs 16 days

to reach South America, and an airship only 6, the difference in time will be ample inducement to many passengers, especially to wholesale merchants, and the higher fare will be gladly paid. In the same way, saving of time in transporting mail is of the greatest importance; and the revenue of such postal transport will form the very backbone of airship transportation.

Towards the end of the war, a speed of about 140 km. per hour was attained by naval airships. Higher speed was not considered advisable, but it might naturally be attained. Speeds of about 140 km.p.h. would certainly be sufficiently high for commercial airship transport. The opposing winds would rarely attain such a degree or exceed it.

There is scarcely any more risk in travelling by airship than by a giant airplane. The danger of gas explosions can be almost entirely done away with by taking proper precautions. Much has been said about the danger incurred by the airship from lightning. During the war, Germany lost only one airship through lightning stroke, and even that one was due to special circumstances (exhaust of the airship) which might have been avoided had suitable precautions been taken. Later on, flying airships have been struck by lightning on several occasions without any detrimental results whatever. A giant airplane runs just as much or as little risk from lightning as an airship, on account of the large dimensions of the former.

The lecturer expressed his opinion that not even in future would there be any likelihood of rivalry between the giant air-

plane and the airship in carrying heavy loads and traversing long distances, all the advantage being on the side of the airship. The question of the quantity of fuel to be carried will settle the point. At present, there is no object in discussing it theoretically; practice will result in proof.

Professor JUNKERS, of Dessau, expressed his pleasure at finding so much importance attached to the airship, and consequently to the work of the Zeppelin in peace-time aviation. The airship still continues to be superior to the airplane for long journeys on account of its favorable lift/drift ratio; but higher speed may certainly be more easily attained by the airplane, the work expended being the same for similar distances with constant lift/drift, independent of the speed. In the case of the airship, on the contrary, the drift increases as in land and water vehicles, - at least with the square of the speed.

With regard to the constructional material for airplanes, the speaker stated that favorable results had been obtained in respect of the durability and weather-resisting qualities of all-metal airplanes, showing metal to be highly suitable as material for constructing economical transport airplanes.

Major General OSCHMANN, of Berlin, seconded Herr ENGBERDING'S remarks and gave a report on the exceptionally favorable achievements of military airships during the war. A distance of about 7000 km., for instance, was covered by a military airship in an uninterrupted flight, in most unfavorable weather, in 96 hours. The radius of action of the ship is said to have

been still better in northern latitudes, and further improvements in power may be attained in peace-time, when smaller loads and lower flight altitudes may be reckoned with. There can thus be no doubt as to whether a ship of the kind can solve the old problem of traversing the ocean. German airships are capable of it and are destined to do so. The greatest of all lines of aerial communication therefore lie within the domain of the airship.

For the time being, the scope of the airplane must be limited to a more limited range - as carriers to the main lines, like the automobile - as the first stage in their utilization for transport. And the aim of developing the airplane to such a degree that it may later be used, in a perfected form, for long distance journeys must always be kept in view and striven after. Such a perfected type of airplane will be somewhat similar to the G airplane. The R airplane seems little likely to find rational utilization in transport work, at the present time.

First Lieutenant NIEMANN, of Berlin, remarked that aerial navigation of the future, - especially if a regular time-table be followed - cannot possibly be undertaken without reliable navigating instruments. The most important of these are as follows:

1. The centrifugal inclinometer, which shows the temporary position of the airplane in space and renders it possible to keep it in the right position when flying through clouds and mist.

2. The wireless "Airplane Pathfinder" enables the pilot to determine the position of the wireless airport station at any time by means of a device for registering the direction. This device is extremely easy to manipulate and gives readings on a graduated scale. It is also advisable for the development of aerial transport that all aerial stations should be provided with wireless receivers. The above-mentioned method is an improvement on the previously utilized wireless sounding process such as the cross-sounding (Kreuzpeilung), the direction transmitter receiver, the wireless compass, etc., because the pilot can direct any airplane, without special training, to the flight station from long distances.

3. By means of the electric-acoustic altitude meter, exact measurements can be taken at altitudes below 300 m. over the extended ground. Disconnected tones, produced by a siren, are transmitted to the ground through a bell-mouth at an angle depending upon the speed of the airplane. The waves of sound, reflected from the ground, are taken up in the airplane by means of the electric acoustic altitude meter, and the acoustic waves are transformed into an electric wave. The difference in time between the transmittal and reception of the wave gives the flight altitude. The last 5 m. over the ground are determined by a hanging wire, which lights an electric lamp in the pilot's cockpit when it touches the ground, and thus gives the signal for landing. Herr NIEMANN stated that the process was worked out by the Wireless Testing Department.

The structural finish of the instruments now utilized - the manufacture of which was almost completely interrupted by the Revolution - is of the greatest importance in the development of aviation. Even after such short experience, wireless telegraphy is an important aid to aerial transport, and it will develop in other directions and become a formidable rival, especially in aerial mail transport, through the establishment of wireless express telegraphy and wireless transmittal of written matters and photographs.

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